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United States Department of the Interior

NATIONAL PARK SERVICE
Pacific West Region
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Wendy R. Dixon, EIS Project Manager
Yucca Mountain Site Characterization Office
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
P.O. Box 30307, MS010
North Las Vegas, NV 89036-0307

Dear Ms. Dixon:

The National Park Service wishes to express appreciation for the opportunity to review and comment on the draft Environmental Impact Statement (EIS) for a proposed *Geologic Repository for Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste* at Yucca Mountain, Nye County, Nevada.

As you are aware, Death Valley National Park, the largest national park in the lower 48 states, is only 22 miles down-gradient from the Yucca Mountain Site. Furthermore, Lake Mead National Recreation Area and Great Basin National Park are situated along transportation routes leading to the proposed site. The U.S. Congress has entrusted the National Park Service with the inviolable mandate to protect and preserve these superlative areas in perpetuity. Thus the National Park Service takes considerable interest in the proposed disposal of radioactive waste at the Yucca Mountain Site.

1... If the facility were built and operated as proposed, and never leaked into groundwater or elsewhere, it could be acceptable. Of course, if that were true, the facility could be built anywhere. A paramount concern underlying our comments is that things that can

...1 go wrong sometimes do. Should something go awry at the top of the geologically active Yucca Mountain system, irreplaceable resources existing downstream will be affected. Thus, even if one accepts the as yet unproven premise that the possibility of leaks is small, the consequences of leakage would be catastrophic. And, unfortunately, such an incident is possible within decades, centuries, or even millennia of operational start-up.

2 Staff at Death Valley National Park have been informed that ongoing studies of the regional groundwater aquifer systems will be terminated with the completion of a steady state model of the Death Valley Groundwater Flow System (coincidental with permitting of the repository, if that results). Should this occur, we are alarmed that the benefit of a basic long-term baseline for continuing to understand environmental effects will be lost. We firmly believe the model studies not only should be maintained, but expanded to include several transient model analyses to enhance our knowledge of the regional groundwater flow system.

26 The enclosed comments have been prepared to aid the Department of Energy in supplementing the environmental impact analysis necessary for adequately completing the EIS process. The National Park Service contends that the analysis completed thus far is inadequate with regard to foreseeable and very harmful direct and indirect effects off-site. Should leakage occur into the aquifer underlying Yucca Mountain, irreparable damage to national park and regional resources will occur.

3 Based on information available so far, the National Park Service must oppose the
4 proposed action. Accordingly, we firmly believe that a supplementary environmental impact analysis effort must be conducted. This additional analysis must address hazards to National Park System units, and equally important, the potential economic impacts of decreased tourism in this part of California and Nevada should mishaps occur.

For questions regarding our concerns, or to request clarifications of our comments or additional information to aid your revising the document, please contact:

Mr. Mel Essington, Mining Engineer, Death Valley National Park, (760) 786-3257.

Mr. Roy Irwin, Senior Contaminants Specialist, Water Resources Division, Natural Resources Program Center, (970) 225-3520

Mr. William van Liew, Hydrologist, Water Resources Division, Natural Resources Program Center, (970) 225-3549.

Dr. Mietek Kolipinski, Team Leader, Natural Resources, Pacific Great Basin Support Office, (415) 427-1430.

We trust you will find these comments useful for framing your reconsideration of inadequate aspects of the draft EIS, as well as for informing your evaluation of all the significant factors affecting the eventual decision.

Sincerely,

John J. Reynolds,
Regional Director
Pacific West Region
National Park Service

Enclosure

cc:
Supt., Great Basin NP
Supt., Lake Mead NRA
Supt., Death Valley NP
Chief, Water Resources Division
Chief, Environmental Quality Division

National Park Service comments regarding the U.S. Department of Energy's Draft Environmental Impact Statement for a proposed *Geologic Repository for Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste* at Yucca Mountain, Nye County, Nevada.

GENERAL COMMENT:

5 The draft EIS is well-written--as far as it goes--and represents considerable work on the part of the U.S. Department of Energy (DOE) and its contractors concerning potential environmental impacts arising from operating a proposed long-term high level nuclear waste storage facility at
6 the Yucca Mountain site. The effort necessary to prepare this voluminous draft EIS notwithstanding, the NPS has reservations about the inadequacy of the environmental impact analyses regarding potential **off-site impacts** of the proposal. In general, the National Park Service (NPS) believes the draft EIS is deficient in its analysis of potential impacts to the regional environment and totally avoids discussion of foreseeable impacts to national park resources. While some discussion addresses possible impacts to human residents in the Amargosa Desert area, comparatively little analysis is given to impacts upon ecosystem integrity, regional resources, endangered fish and invertebrates, and rare biota.

7 Uncertainties underlying the proposal are not adequately disclosed. For instance, §5.2.3.5 obscurely states that confidence in models to predict radionuclide concentration reduction through both saturated and unsaturated zones is low, and that the significance of this uncertainty to the estimated repository performance is high. Importance of the uncertainty factors is not sufficiently discussed throughout. To foster uninformed readers' understanding of the proposal (and its effects), we urge that the many uncertainty factors--preventing scientists from saying much of anything with a high degree of confidence about overall safety--be clearly set forth in the beginning of the Summary and in the Findings.

Our other concerns are related primarily to water resources, specifically the critical water resources of Death Valley National Park and its Devils Hole Detached Management Unit at Ash Meadows, Nevada. Additional concerns stem from threats to the environment and public health and safety posed by transporting nuclear waste materials through or near Death Valley National Park, Great Basin National Park, and Lake Mead National Recreation Area.

8... The proposed waste repository site is located in a volcanic rock sequence directly overlying carbonate rocks that comprise a regionally significant, deep Carbonate Rock Aquifer, and is also contained in the Death Valley Ground-Water Flow System. These are both known to discharge at Death Valley NP. Ground-water discharge at park springs is the sole source of water for critical park water and water related resources and provides domestic water resources for park visitors and staff, the Furnace Creek Resort complex, state and county staff, and Tribal groups and areas.

The draft EIS inadequately addresses radionuclides leaking from the proposed repository, which will migrate to the water table and contaminate regional ground-water flow systems that ultimately discharge at springs in Death Valley NP and at Devils Hole. The NPS is mandated

...8 to protect resources entrusted to its care in perpetuity. Dangerous levels of radiation may exist long after the predicted 10,000-year life of the repository.

For example, Neptunium 237, which constitutes an important human health risk, is listed as a constituent of the waste packages that are planned to be disposed of in the Yucca Mountain repository. Neptunium 237 has a half-life of 2.1 million years. Leakages involving this element alone could result in serious contamination of park water resources.

9 Adequate discussion is not provided in the draft EIS regarding the proposed repository container's vulnerability to damage from seismic disturbances (i.e. earthquake hazards) common to this area. We recommend the Department of Energy obtain from the U.S. Geological Survey the predicted earthquake scenario for this area, over the next century at a minimum. The NPS is concerned that any seismic damage may contribute to potential release of radionuclides into the environment (specifically the regional ground-water flow system that underlies the proposed repository) and thence discharged at down-gradient springs (specifically water flows in Death Valley NP).

10 Conclusions presented in the draft EIS and state of knowledge concerning the groundwater flow system are based on prevailing hydrologic conditions affecting the operation of the regional flow system. Additional transient modeling studies employing logical and predictable changes to significant parameters affecting the model outcome are necessary to determine the response of the flow system to continued development and increased groundwater withdrawals.

Such analyzes utilizing variations in precipitation and groundwater recharge are essential to achieve anything approaching a reasonable understanding of response the flow system will have to those changes. Absent that data no reasonable conclusions can be derived concerning potential impacts associated with groundwater movement in the area of Yucca Mountain and the proposed repository. The NPS recommends that conservation planning concluded thus far be modified to include the logical and necessary completion of these absolutely essential groundwater studies through full analysis via transient model studies.

11 In addition, the NPS believes that the draft EIS inadequately assesses the effects of possible climate changes over the next 10,000 years. Increased precipitation (even in a few decades) could conceivably result in the transport of radionuclides from the proposed repository to the water table, and other effects not identified or analyzed in the draft EIS.

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SPECIFIC COMMENTS:

§3.1.1.1 *Regional Land Ownership* -- This section indicates the NPS manages Death Valley NP (approximately 22 miles southwest of Yucca Mountain). However, Figure 3-1 does not show the correct boundary for Death Valley NP (it depicts the pre-1994 boundary of the former Death Valley National Monument). Additional lands now administered by NPS could

...12 potentially be affected by the release of contaminants from the proposed repository. This greater effect must be assessed in the final EIS.

13 §3.1.2.2 *Climate* – This section states that annual precipitation in the area ranges from approximately 4-10 inches. However, no analysis is accorded to potential changes in climate over the next 100-1,000-10,000 years. It is important to note that in the last 10,000 years, there have been substantial, documented changes in climate in this region, including periods of much wetter climate than at present. This significant factor must be assessed in the final EIS (likewise in §5, Environmental Consequences of Long-Term Repository Performance).

14.. No mention is made in the draft EIS of studies that have been conducted that have simulated the effects of potential increased infiltration at the proposed site (due to a wetter climate). One such study, for example, was published in the *Journal of Ground Water* of the Association of Ground Water Scientists & Engineers, July-August 1999, entitled *Numerical Modeling of Perched Water Under Yucca Mountain, Nevada,* by J.J. Hinds (of Lawrence Berkeley National Laboratory) and others. Significant excerpts are as follows:

> "These perched water bodies are believed to have important implications for ground water travel times and flow pathways, and for radionuclide transport through the unsaturated zone. Perched water could potentially increase corrosion rates of engineered waste canisters and shorten ground water travel times, leading to more rapid and focused dispersal of radionuclides to the environment. Consequently, a thorough understanding of perched water dynamics is necessary for site evaluation."

> "To investigate the effect of a wetter climate on the unsaturated flow regime, we use the approximate steady-state results from the base-case scenario as our initial conditions and increase the infiltration rates by a factor of five ...a simulation time of 10,000 years is used, since it represents the period of time over which the waste should remain isolated."

The article goes on to state effect of higher infiltration rates on the perched water system is substantial:

> "The simulations presented in this study illustrate how contrasts in...climate...can affect moisture distribution and flow within the unsaturated zone and, particularly, the perched water system under Yucca Mountain. The persistence of perched water has important implications for waste isolation. The migration of radionuclides away from a potential repository may accumulate in perched water bodies and may become focused along structural pathways, like faults, that cut through the major hydrogeologic units and provide a direct link to the water table, allowing flow to bypass sorptive zeolites. The simulations presented here illustrate that moisture, accumulating at lithologic boundaries to form perched water, may drain to the water table along fault zones. Additional results show that the size of perched water at Yucca Mountain is sensitive to changes in climate. The introduction of more moisture into the subsurface by increasing infiltration leads to shorter ground water travel times and growth of perched water bodies..."

We contend based upon this material that the draft EIS is inadequate in assessing effects of possible climate changes over the next 10,000 years on the likelihood of transport of

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...14 radionuclides from the proposed repository to the water table, and the regional ground-water flow systems, which discharge at Death Valley NP.

15 §3.1.3.1 *Geology, Physiography, Potential for Volcanism at the Yucca Mountain Site* -- The narrative indicates that during 1995-96:

> "...DOE convened the panel of recognized experts...to assess uncertainties associated with the data and models used to evaluate the potential for disruption of the potential Yucca Mountain Repository by a volcanic intrusion (dike). The panel estimated the probability of a dike disrupting the repository during the first 10,000 years after closure to be 1 chance in 7,000."

However, the draft EIS does not evaluate the effects from such a disruption occurring. No discussion is included as to the structural integrity of radioactive waste canisters if such an event should occur, and what such disruption might mean for the possibility of leakage and transport of radioactive constituents away from the proposed repository and into the regional groundwater flow systems.

16... §3.1.3.2 *Modern Seismic Activity* -- The narrative indicates that the DOE has monitored seismic activity associated with the Nevada Test Site since 1978. In the section on "Seismic Hazard", it is stated that:

> "DOE based the design on ground motion and fault displacement that could be associated with future earthquakes at Yucca Mountain on the record of historic earthquakes in the Great Basin, evaluation of prehistoric earthquakes based on investigations of the faults at Yucca Mountain, and observations of ground motions associated with modern earthquakes..."

Later in this section, it is stated that:

> "DOE needs to complete additional investigations of ground motion site effects before it can produce the final seismic design basis for the surface facilities."

Further, it is stated in this same section that:

> "A recent study...claims that the crustal strain rate in the Yucca Mountain area are at least an order of magnitude higher than would be predicted from the Quaternary volcanic and tectonic history of the area. If higher strain rates are present, the potential volcanic and seismic hazards would be underestimated on the basis of the long-term geologic record. If the higher strain rates are confirmed, DOE will reassess the volcanic and seismic hazard at Yucca Mountain."

It would appear from these statements the DOE has potentially underestimated the potential volcanic and seismic hazards at the proposed site. The DOE acknowledges the need for additional studies before it is able to assess the effects of the earthquake hazard on the proposed repository. The NPS is concerned what this deficiency might mean for the assessment of potential risks of release of radionuclides into the environment (specifically the regional ground-

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...16 water flow system that underlies the proposed repository) and exposure to down gradient springs in Death Valley NP.

17 §3.1.4.1 *Hydrology, Surface Water , Regional Surface Drainage* -- The draft EIS acknowledges that the Amargosa River system drains Yucca Mountain and the surrounding areas, and flows into the Badwater Basin in Death Valley. Nonetheless, potential environmental consequences (within Death Valley NP) due to possible leakage of harmful radioactive constituents from the proposed repository or from transportation into this surface drainage are not considered in the draft EIS.

18 §3.1.4.2.1 *Groundwater, Regional Groundwater* -- This section states:

> "DOE has collected groundwater-level data from wells at Yucca Mountain and in neighboring areas on a routine basis since 1983, and has used the levels to which water rises in wells---called the *potentiometric surface*---to map the slope of the groundwater surface and to determine the direction of flow. Based on these and other data, groundwater in aquifers below Yucca Mountain and in the surrounding region flows generally south toward discharge areas in the Amargosa Desert and Death Valley (Figure 3-13)."

However, Figure 3-13 (p.3-38), which is modified from D'Agnese, et al., shows a question mark on the groundwater flow arrow from the Amargosa Desert area towards Death Valley NP. Figure 32 in the referenced D'Agnese, et al. report (1997) is essentially identical to Figure 3-13 in the draft EIS, except that D'Agnese's Figure 32 does not have the question mark on the subject groundwater flow arrow.

Further, Figure 27 (p.60), in this same D'Agnese, et al. report, clearly shows, as the statement from the draft EIS above indicates, that the potentiometric surface indicates that the direction of flow in the regional ground-water flow system is from the Yucca Mountain area toward the Furnace Creek Wash area in particular, and to Death Valley NP in general. This evidence of groundwater flow from the Yucca Mountain to the Furnace Creek Wash in Death Valley NP is corroborated by other potentiometric-surface maps and ground-water flow direction maps published by other scientists, including: Thomas and others (1986), Plates 1 and 2; Harrill and others (1988), Plate 2; Dettinger, (1989), figure 6; Dettinger and others (1991), Plate 2; Laczniak and others (1996), Plate 1; and Harrill and Prudic (1998), Figure 14.

19 In addition, Figure 29, "The three subregions of the Death Valley regional ground-water flow system that encompass the area modeled in the study" of the D'Agnese, et al., report indicates that there is ground-water flow out of the Central Death Valley Subregion into the Southern Death Valley Subregion, and thence northwestward into Death Valley NP, along the path of the Amargosa River; presumably in the alluvial aquifer of the Amargosa River drainage. This ground-water pathway for the migration of nuclear contamination is not considered in the draft EIS, which is a significant omission handicapping the adequacy of the preliminary environmental impact analysis with respect to environmental consequences within Death Valley NP.

20 §3.1.4.2.2 *Groundwater at Yucca Mountain, Hydrologic Properties of Rock* -- This section provides an overview of the hydrologic properties of various types of rock including their transmissivity and hydraulic conductivity. The discussion leads the reader to conclude groundwater moves extremely slowly in the area of Yucca Mountain; and leaves the reader to conclude little impact may arise from the relative movement of groundwater.

Dettinger in his 1989 report (p.16) states:

> "Some zones within the central corridor (of the Regional Carbonate Aquifer) are highly transmissive, as indicated by large spring discharges that are fed by parts of the aquifers having imperceptibly sloping water tables, and by geologic mapping of ancestral flow paths. The highly transmissive zones may act as large-scale drains, collecting water from adjacent, less transmissive rock that underlies most of the study area."

He goes on to state:

> "Results from tests of carbonate-rock aquifers throughout eastern and southern Nevada indicate that within 10 miles of regional springs, aquifers are an average 25 times more transmissive than they are further away."

The springs at Ash Meadows and Death Valley are high volume, constant discharge springs known to be supported by the regional aquifers. If Dettinger's observations are correct then the areas surrounding them are typified by accelerated groundwater transmissivities. This occurrence is further supported by the recent discovery of subterranean amphipods being discharged from the groundwater aquifers at Death Valley. The presence of these organisms necessitates the occurrence of open space fractures or voids at some considerable distance from the springs. These fractures would result in enhanced groundwater flow.

These data indicate the rapid movement of groundwater surrounding the springs. If that area is of the magnitude theorized by Dettinger any contamination originating at the Yucca Mountain site would be rapidly transported to Death Valley NP and Ash Meadows springs. The environmental consequences of such an occurrence are not discussed in the draft EIS.

21.. §5.1 *Environmental Consequences of Long Term Repository Performance, Inventory for Performance Assessment Calculations* -- Table 5-1 lists the average radionuclide inventory of waste packages to be emplaced at the proposed repository. The table lists nine radionuclides. Other than carbon 14, which has a half-life of 5,700 years, the radionuclides that comprise the proposed waste packages have half-lives that range from 24,000 years (Plutonium 239) to 16,000,000 years (Iodine 129). Neptunium 237, a key radionuclide that is thought to play an important role in human health risk, has a half-life of 2,100,000 years.

...21 §5.2.4 *Uncertainty Associated with Models and Model Parameters* – The draft EIS states:

> "The total system performance model used to assess the impacts from groundwater migration includes a very large number of submodels and requires a large amount of input data to estimate the performance of the system."

In a contrasting article published in the *Journal of Ground Water* of the Association of Ground Water Scientists & Engineers, July-August 1999, by Konikow and Ewing, entitled: "Is Probabilistic Performance Assessment Enough?", it is stated that:

> "The U.S. Department of Energy has just released the congressionally mandated 'total systems performance assessment' as part of the viability assessment of the proposed nuclear waste repository at Yucca Mountain. The linking of multiple, complex, deterministic models in the PA approach makes it difficult to find and analyze weaknesses in the underlying conceptual models or even errors generated by faulty linkages and inconsistent assumptions among various submodels. We urge extreme caution before accepting the probabilistic outcomes generated by the PA approach. In summary, we offer a quote from Ansel Adams: 'There is nothing more disturbing that a sharp image of a fuzzy concept.'"

There is excessive imprecision in the uncertainty analysis for the proposed repository at Yucca Mountain, due to the coupling of various models, each of which employ many assumptions. The degree of uncertainty in the analysis of long term environmental consequences is not and cannot be adequately assessed, due to the coupling of these various models, each of which has inherent uncertainty.

22 §5.3 *Locations for Impact Estimates* – The draft EIS uses an analysis that estimates impact due to the potential transport of radionuclides in ground water for four distances away from Yucca Mountain. The farthest distance away from Yucca Mountain is termed the "discharge location". That location is at the Franklin Lake Playa. The analysis of locations for impact estimates given in the draft EIS is incomplete. No analysis was conducted for impacts to ground-water discharge points in Death Valley NP or its Devils Hole Detached Management Unit even though these are known discharge locations from the regional ground-water flow systems.

23 §5.4 *Waterborne Radiological Consequences* – This section of the draft EIS does not address potential waterborne radiological consequences to Death Valley NP, its resources, staff, or visitors from water from the regional groundwater flow systems overlain by the proposed repository. Analysis of those potential impacts must be completed in the final EIS.

Also, there is little explanation of the basis for the estimation of a 1,150 person-exposure to possible groundwater contamination events within 50 miles of the proposed site. We are concerned this underestimates the current combined population and daily visitation in the area, and is even more inconsistent with projected trends into the foreseeable future.

24 §5.7.3 *Consequences from Disruptive Events, Seismic Disturbances* -- In this section, it is stated that:

> "The probability of earthquake occurrence in the Yucca Mountain vicinity is sufficiently high that DOE evaluated potential effects of seismic activity on repository performance. The potential effects of seismic activity would be vibratory ground motion in the repository, causing falling rock to damage waste packages, and a nearby event causing changes in hydrologic properties."

Later in the section, it is stated that:

> "Most waste package failures caused by seismic activity probably would occur when the waste package outer wall was completely corroded. ... At times greater than 100,000 years after repository closure, damage from falling rocks would be more likely because the waste packages would be corroded. ... There is less than a one- percent probability that a falling rock would breach a waste package during the first 10,000 years after repository closure... Over 1 million years, falling rocks could breach about 30 percent of the waste packages in the repository."

The DOE states that waste packages are subject to corrosion. The DOE admits that the probability of seismic events that might breach a waste package in the proposed repository is approximately 10^{-2} during the first 10,000 years, and that after 1 million years, about 30% of the waste packages could be breached. Given that potentially harmful radionuclides with half-lives of well over 1 million years (e.g. Neptunium 237) are to be included in these waste packages, the draft EIS does not address the potential effects of seismic hazards on repository performance, especially the structural integrity of the waste packages, and subsequent effects on down-gradient springs if the packages leak. It is also suggested that the supplemental draft EIS address whether--within an accelerated timeframe for possible radionuclide contamination due to seismic damage--necessary remediation and restoration sciences will be refined sufficiently to respond to impacts which ensue.

25... §6.0 *Environmental Impacts of Transportation* – The NPS objects to transportation of nuclear waste materials in and near the boundaries of its management units. Hazardous waste contamination of park land from ancillary transportation is already a major problem. Each year millions of dollars and unnecessary employee time is expended on these issues. These costs drain important funding from areas and projects necessary for the maintenance of park units. The possibility of the spill or inadvertent release of radionuclides within or neighboring a park unit is unacceptable.

State highways adjoin or are adjacent to Death Valley and Great Basin NP's and Lake Mead NRA. Any accidental spills arising from transportation will directly affect the parks. Not only will park resources be affected, but park emergency response staff will be necessarily deployed. The proposed Yucca Mountain transportation plan does not provide for adequate trained emergency response staff or other resources to deal with highway accidents affecting the parks. Relying on NPS staff to respond to highway accidents involving high-level nuclear waste is unacceptable.

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...25 For example, California Highway 127 parallels the drainage of the Amargosa River over a great distance in proximity to Death Valley NP. Flow measurements published by the U.S. Geological Survey give evidence of periodic surface flows in that drainage. Flows may originate at Oasis Valley, Forty Mile Wash, or a host of other locations and continue to the terminus of the system at Badwater Basin in the park. The draft EIS provides neither any discussion of the outcome should an accident occur releasing material into the park along this route, nor a risk analysis of this possibility.

The supplemental EIS must address this omission with regard to both Nevada State Highway 95 and California State Highway 127, identifying and assessing scenarios for Great Basin NP and Lake Mead NRA (in addition to Death Valley NP).

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